Ontology-Driven Adaptive Accessible Interfaces in the INREDIS project

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Abstract. This paper presents and architecture that is being developed to generate adaptive accessible interfaces taking into consideration the features of users with disabilities, the characteristics of the devices that they use to access remote services, and other context features. In order to perform the modelling of the diverse parameters under consideration an ontological approach has been chosen. This research is part of the INREDIS project that has the purpose of creating a universally accessible, interoperable and ubiquitous environment to allow people with disabilities to control service machines and /or different targets.

Keywords: adaptive interfaces, accessibility, ontologies, user modelling.

1 Introduction

Services that are accessible through the Internet should be accessible, ubiquitous, and interoperable. Unfortunately, this is not the current situation since most interfaces do not take into account the needs of the users nor the context in which the interaction is performed. The specific characteristics of the device used to request the service are also frequently ignored, which has a negative impact on the accessibility, usability, ubiquity and interoperability of the service. Adaptation is very helpful to overcome accessibility barriers. It is based on user modelling that allows tailored interactions based on relevant user features such as skills, preferences, interests, etc. In addition, a number of other context features are taken into account to optimize the adaptation process, such as the task and the objective that the user wants to achieve.

The research work presented in this paper is carried out in the framework of the INREDIS project [1], which aims to provide universal accessibility, interoperability and ubiquity in order to allow people with disabilities to control service machines, vending machines, home appliances, etc. In this paper we aim to depict the architecture of the Interface Generator module that is used to produce adaptive interfaces taking into account the relevant characteristics of users with disabilities and context features, including the characteristics of the devices used to access these services. Ontologies are used in order to perform the modelling of the diverse parameters taken into consideration because they allow reusability, besides they allow extracting new information through inferences.

In relation to the method for storing and processing data for modelling, some approaches propose mark-up languages to model the user (e.g. HumanML [2]) while others propose the use of ontologies (such as GUMO [3]). In addition to the user characteristics, other projects (such as CAP [4]), also consider specific issues related to context. Most of these approaches are predominantly focused on user modelling. Though, adaptive interfaces devoted to the support of people with disabilities have to consider several other issues included in the interaction context, such as accessibility [5] [6] or affective resources [7]. Taking into account the principal advantages offered by these researches, our approach is focused on modelling not only the user but also the technological context and non-technological context.

3 The INREDIS Approach

In order to create adaptive accessible interfaces for people with disabilities within the INREDIS project, a module called the "Interface Generator" has been designed. Its aim is to provide universal access for anyone, including people with disabilities, regardless the device used or the service that is accessed. To achieve this objective, it is necessary to model the different aspects of the domain where the user is interacting. Several approaches have been studied to model these features and eventually an ontological model was chosen, since ontologies offer automated reasoning, dynamic classification and consistence checking giving the opportunity of extracting other relevant features without interfere the user.

In order to take into account all relevant aspects of the user and his context, three different ontologies have been designed and some others are still in the conceptualization phase. Subsequently, all the ontologies designed have been integrated through a global ontology that is modular enough to encompass future ontologies, if they are needed. *User ontology* has been designed to model the skills and characteristics of the users. *User Device Ontology* aims to gather all the information about the device used by the user to interact with the system. *Target Ontology* has the objective of modelling the characteristics of the possible targets or services that can be integrated, such as ATMs, vending machines, and so on.

In addition to these ontologies, there are others in the conceptualization phase that will be built when they are required. These are *Interface Ontology* to guide the process of deciding interface mark-up language and components*; Adaptations Ontology* to model the best adaptations for each user stereotype; and *Assistive Technologies Ontology* to model the diverse assistive technologies accessible trough the INREDIS framework. More information can be obtained in [8].

4 Proposed architecture and component modules

The architecture designed to generate adaptive accessible interfaces is composed of diverse modules, each one provided with specific functionalities to perform specific tasks. It is highly flexible to enable the incorporation of new modules providing new functionalities in the future. *IG Manager Module* is an orchestrator that manages the

whole process and the functionalities of the Interface Generator. *Constructor Module* is responsible for creating a default interface in an abstract language. *Resources Manager Module* analyses the resources provided by the target to determine whether these resources are compatible with the user and the user's device. *Selector Module* has to decide which adaptations must be performed to obtain an accessible interface. *Adapter Module* applies the adaptations selected by the selector module to the default interface, obtaining an adaptive accessible interface, supported by the user and his/her device and which is able to control target functionalities. *Data Injector Module* checks whether there is an interface previously generated for the current type of user, device and target. More information about these modules can be obtained in [8].

5 Conclusion

A prototype has been developed to verify the adequacy of the architecture proposed. Although the interaction with the ontologies was only simulated, this prototype showed the functionality and validity of each module and detected its inconsistencies and deficiencies. We are currently developing a more complete version of the Interface Generator that extends its features to allow adaptation to all the stereotypes provided by the general ontology, regardless the device and the target.

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